# Section 12 ■ CONTENTS



TABLES

# Section 12
# WATER POLLUTION CONTROL

This section presents data and information on existing levels of water pollution throughout the basin. Sources of pollution are identified, problems and solutions are discussed, and recommendations are given for control and improvement by responsible agencies.

## 12.1 INTRODUCTION

With some important exceptions, most groundwater in the Bear River Basin is good quality and suitable for culinary use with little or no treatment.[1] The major exception is in Box Elder county in areas near the Great Salt Lake. Essentially all of the municipal, industrial, and domestic water in the basin comes from high-quality groundwater sources. The quality of surface water, however, varies widely because of both natural effects and human activity. In the upper basin, where the Bear River enters Utah from Wyoming, water quality is considered good. Water temperatures are low, as are TDS (total dissolved solids), alkalinity, electrical conductivity, hardness, and sulfates. But the quality deteriorates as the river flows downstream. Return flow from irrigated land, sediment, animal wastes, municipal and industrial wastewater, natural saline springs, agricultural chemicals, and warmer temperatures combine to cause water quality problems in the lower basin. In general, each tributary stream shows a similar pattern of downstream deterioration, although some are much better than others.


Ashley Anderson - Grand Prize Winner, 1990
Young Artists Water Education Poster Contest

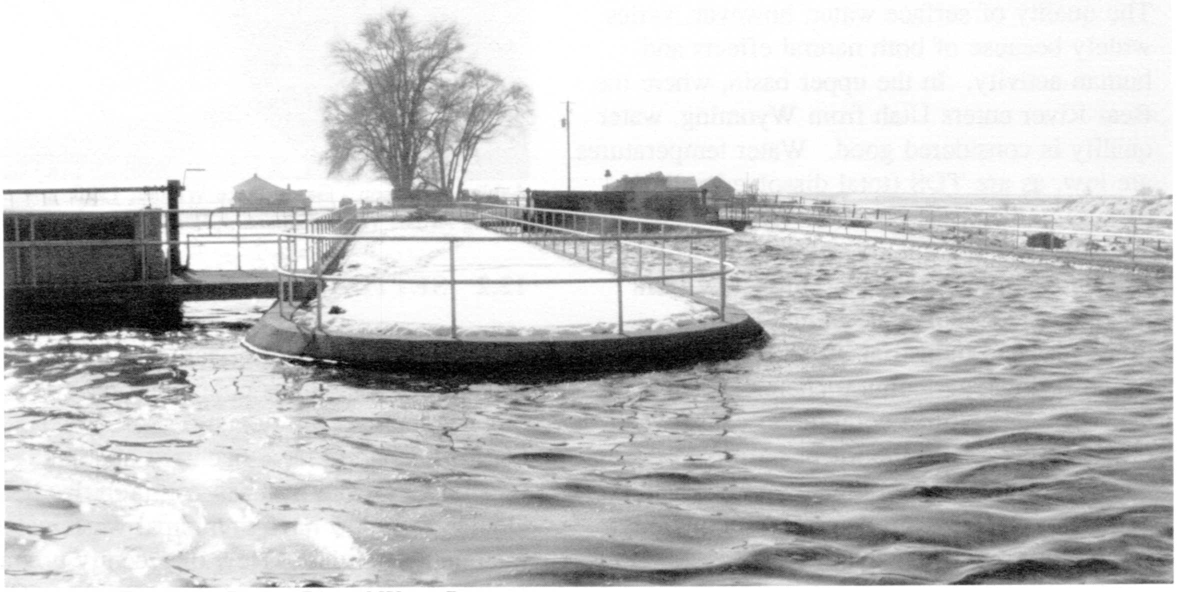
## 12.2 SETTING

Chronic and occasionally serious wastewater discharges containing high biochemical oxygen demand (BOD) and coliform bacteria have occurred at some locations. Of the 35 Utah communities below Oneida Dam, 15 have municipal wastewater treatment facilities[1]. New or recently upgraded facilities are located in Hyrum, Brigham City, Tremonton, Logan, North Logan, River Heights, Smithfield, and Providence. Table 12 is a listing of current municipal treatment facilities for the basin, and the stream to which they discharge. Generally, most of these falcilities are in compliance with their discharge permit. Many additional communities are contemplating construction of sewage collection and treatment systems.

### 12.3 REGULATION

The 1991 Legislature created the Department of Environmental Quality, a new department of Utah state government that formerly was the Division of Environmental Health. Within the new department, several existing agencies are elevated to division status. The Division of Water Quality (formerly the Bureau of Water Pollution Control) is of special interest to this report.

The Utah Water Quality Board has the following responsibilities: (1) developing and updating regulations and policies, (2) enforcing water quality discharge limits and treatment standards, (3) classifying the waters of the state according to use, and (4) setting water quality standards, including numeric criteria. Numeric water quality criteria are used to calculate discharge limits for municipal and industrial discharges, to evaluate the impact of point and non-point source pollution, and to determine the achievement of beneficial uses. The use designations are defined by six major classes and nine sub-classes, shown in Table 12-2. The board's classification of streams, lakes, and reservoirs in the Bear River Basin is shown in Table 12-3. Some streams carry different classifications because of multiple uses and changing conditions in various reaches. For example, portions of the Little Bear River and its tributaries are classified as (3A) a cold water fishery, (3D) for waterfowl use, and (4) as a supply for agricultural uses. Porcupine and Hyrum reservoirs are classified (2B) for boating and water-skiing, (3A) cold water game fish and aquatic life, and (4) a source of water for agricultural uses. Cutler Reservoir is classified (2B), for boating and water-skiing (3B), warm water fishery and aquatic life (3D) waterfowl, and (4) a source of water for agricultural uses.



Tremonton Treatment Plant - Div. of Water Resources

TABLE 12-1
EXISTING MUNICIPAL AND INDUSTRIAL WASTEWATER DISCHARGES

| Community/Industry | Receiving Stream |
|---|---|
| Richmond Lagoons | Cub River |
| Logan Lagoons (includes North Logan, Hyde Park, Providence, River Heights, and Smithfield) | Cutler Reservoir |
| Hyrum WWTP | Little Bear River |
| Wellsville Lagoon | Little Bear River |
| Bear River City Lagoons | Malad River |
| Brigham City WWTP[a] (includes Mantua) | Black's Slough |
| Tremonton WWTP[a] (includes Garland) | Malad River |
| Corinne Lagoons | Bear River |
| Con Agra | Wetlands on Great Salt Lake |
| Morton International | Blue Creek |
| NuCor Steel | Malad River |
| Gossner Foods | Cutler Reservoir |
| E.A. Miller | Little Bear River |
| Western Dairyman | Cutler Reservoir |
| Trout of Paradise | Little Bear River |

[a]Wastewater treatment plant.

## TABLE 12-2
## USE DESIGNATIONS BY UTAH WATER QUALITY BOARD

Class 1 - Protected for use as a raw water source for domestic water systems.

Class 1A - Reserved (for future definition).

Class 1B - Reserved (for future definition).

Class 1C - Protected for domestic purposes with prior treatment by treatment processes as required by the Utah Department of Health.

Class 2 - Protected for in-stream recreational use and aesthetics.

Class 2A - Protected for recreational bathing (swimming).

Class 2B - Protected for boating, water skiing, and similar uses, excluding recreational bathing (swimming).

Class 3 - Protected for in-stream use by beneficial aquatic wildlife.

Class 3A - Protected for cold water species of game fish and other cold water aquatic life, including the necessary aquatic organisms in their food chain.

Class 3B - Protected for warm water species of game fish and other warm water aquatic life, including the necessary aquatic organisms in their food chain.

Class 3C - Protected for nongame fish and other aquatic life, including the necessary aquatic organisms in their food chain.

Class 3D - Protected for waterfowl, shore birds and other water-oriented wildlife not included in Classes 3A, 3B, or 3C, including the necessary aquatic organisms in their food chain.

Class 4 - Protected for agricultural uses including irrigation of crops and stockwatering.

Class 5 - Reserved (for future definition).

Class 6 - Waters requiring protection when conventional uses as identified in Sections 2.6.1 through 2.6.5 do not apply. Standards for this class are determined on a case-by-case basis.

## TABLE 12-3
## USE CLASSIFICATION OF WATER IN THE BEAR RIVER BASIN

| STREAMS | |
|---|---|
| Bear River and tributaries, from Utah-Wyoming state line to headwaters (Summit County) | 3A, 4 |
| Bear River and tributaries in Rich County | 3A, 4 |
| Big Creek and tributaries, from Bear Lake to headwaters | 2B, 3A, 4 |
| Swan Creek and tributaries, from Bear Lake to headwaters | 3A, 4 |
| Swan Springs, tributary to Swan Creek | 1C |
| All other tributaries to Bear Lake | 3A, 4 |
| Cub River and tributaries, from confluence with Bear River to state line | 3B, 4 |
| High Creek and tributaries, from confluence with Cub River to headwaters | 3A, 4 |
| Bear River from Utah-Idaho state line to Great Salt Lake | 2B, 3B, 3D, 4 |
| Birch Creek and tributaries, from confluence with Clarkston Creek to headwaters | 3A, 4 |
| Clarkston Creek and tributaries, from Newton Reservoir to headwaters | 3B, 4 |
| Newton Creek and tributaries, from Cutler Reservoir to Newton Reservoir | 3B, 4 |
| Blacksmith Fork and tributaries, from confluence with Logan River to headwaters | 3A, 4 |
| Logan River and tributaries, from Cutler Reservoir to headwaters | 2B, 3A, 3D, 4 |
| Little Bear River and tributaries, from Cutler Reservoir to headwaters | 3A, 3D, 4 |

## TABLE 12-3 (continued)
## USE CLASSIFICATION OF WATER IN THE BEAR RIVER BASIN

| STREAMS | |
|---|---|
| Malad River and tributaries, from confluence with Bear River to state line | 3C |
| Box Elder Creek, from Brigham City Reservoir to headwaters | 3A, 4 |
| Box Elder Creek from confluence with Black Slough to Brigham City Reservoir | 3C, 4 |
| Perry Canyon Creek from U.S. Forest boundary to headwaters | 3A, 4 |
| Willard Creek, from Willard Bay Reservoir to headwaters | 3A, 4 |

| LAKES & RESERVOIRS - - SUMMIT COUNTY | |
|---|---|
| Whitney Reservoir | 2B, 3A, 4 |
| Ryder Lake | 2B, 3A, 4 |
| McPheters Lake | 2B, 3A, 4 |
| Lily Lake | 2B, 3A, 4 |
| Amethyst Lake | 2B, 3A, 4 |

| LAKES & RESERVOIRS - - RICH COUNTY | |
|---|---|
| Woodruff Creek Reservoir | 2B, 3A, 4 |
| Little Creek Reservoir | 2B, 3A, 4 |
| Birch Creek Reservoir | 2B, 3A, 4 |
| Bear Lake (Utah portion) | 2A, 2B, 3A, 4 |

| LAKES & RESERVOIRS - - CACHE COUNTY | |
|---|---|
| Tony Grove Lake | 2B, 3A, 4 |
| Pelican Pond | 2B, 3B, 4 |
| Porcupine Reservoir | 2B, 3A, 4 |
| Newton Reservoir | 2B, 3B, 4 |
| Hyrum Reservoir | 2B, 3A, 4 |

**TABLE 12-3 (continued)**
**USE CLASSIFICATION OF WATER IN THE BEAR RIVER BASIN**

| LAKES & RESERVOIRS - - BOX ELDER COUNTY | |
|---|---|
| Willard Bay Reservoir | 1C, 2B, 3B, 3D, 4 |
| Mantua Reservoir | 2B, 3A, 4 |
| Cutler Reservoir (including portion in Cache County) | 2B, 3B, 3D, 4 |
| **NATIONAL BIRD REFUGE AND STATE WATERFOWL AREAS** | |
| Salt Creek Waterfowl Management Area, Box Elder County | 3C, 3D |
| Public Shooting Grounds Waterfowl Management Area, Box Elder County | 3C, 3D |
| Harold Crane Waterfowl Management Area, Box Elder County | 3C, 3D |
| Bear River Migratory Bird Refuge, Box Elder County | 3B, 3D |

## 12.4 PROBLEMS, NEEDS, AND ISSUES

Water quality problems in the Bear River Basin are complex and pervasive. This basin plan attempts to present only a general overview, and in some cases specific examples of problems. In general, water quality in the Bear River decreases as it flows downstream.

The Utah 1982 Clean Lakes Inventory and Classification Project[8] studied the following impoundments: Bear Lake, Cutler Reservoir, Newton Reservoir, Tony Grove Lake, Hyrum Reservoir, Porcupine Reservoir, and Mantua Reservoir. Those impoundments found to have critical or potential water quality problems, particularly from eutrophication and sedimentation, were Hyrum and Newton reservoirs and Bear Lake. Each is discussed on the following pages, along with specific reaches of the Bear River mainstem and tributaries.

### 12.4.1 Point Source Pollution

Point sources of water pollution are those which result from a discharge at a specific single location and are generally associated with discharges from municipal or industrial wastewater treatment facilities. Wastewater discharges must be permitted by the Water Quality Board, acting through the Division of Water Quality. State water pollution control regulations require, as a minimum, all persons discharging wastes into any of the waters of the state to provide treatment processes which will produce effluent meeting or exceeding Utah Secondary Standards. These standards stipulate that the arithmetic mean of effluent BOD (biochemical oxygen demand) and TSS (total suspended solids) over any 30-day period not exceed 25 mg/l; the geometric mean of effluent total and fecal coliform not exceed 2000/100 ml and 200/100 ml, respectively; and that effluent values for pH (acidity) be maintained between 6.5 and 9.0.

The three counties comprising the Bear River Basin in Utah currently have 10 municipal and eight industrial permitted wastewater treatment facilities. These include:

Municipal

Bear River Town Lagoons
Brigham City WWTP
Corinne City Lagoons
Perry City Lagoons
Tremonton City WWTP
Hyrum City WWTP
Lewiston City Lagoons
Logan City Lagoons
Richmond City Lagoons
Wellsville City Lagoons

Industrial

Con Agra - Land Application
Morton International Industrial WWTP
NuCor Steel Lagoons
Thiokol Industrial WWTP
Gossner Foods Lagoons
E.A. Miller Lagoons Treatment Plant/Lagoons
Western Dairyman's Cooperative Lagoons (Amalga)
Trout of Paradise

In addition, a number of facilities do not discharge and are not required to obtain a permit from the state. These include:

Bear Lake Special Service District Lagoons
Sweetwater Lagoons
Bear Lake State Park Lagoons
Willard Bay State Park Lagoons

Many areas of the Bear River Basin have high groundwater levels, inadequately sized septic tank/drainfield systems, residential lots of inadequate size to support on-site disposal systems, and systems located in soils of low percolation rates. Because of these conditions, some communities have recently received state and federal funds for planning, design, or construction of centralized wastewater collection and disposal systems. These communities include:

Smithfield City
Providence City
Hyde Park City
Willard City (planning only)
Bear Lake South Shore (planning only)

Major upgrades were completed recently at the Logan City Lagoons and Brigham City Wastewater Treatment Plant. In spite of these efforts, the capital cost expenditure to meet current wastewater needs in the Bear River Basin is estimated at $346.5 million (1990 dollars). The capital cost to meet the area's wastewater needs to the year 2008 is estimated to be $524.2 million (1990 dollars).

### 12.4.2 Non-point Source Pollution

"Non-point sources" (NPS) of water pollution are those not resulting from discharge at a specific single location (e.g., a pipeline outflow). NPS pollution is associated with natural sources and with human activities such as agriculture, construction, mining, recreation, urban runoff, channel modifications, and forest management. It is very difficult to control. NPS pollution is a major contributor to water quality problems in the Bear River Basin, and is recognized by the U.S. Congress as a major contributor nationwide. The 1987 Federal Clean Water Act (Section 319) established provisions to control NPS pollution.

In Utah, the Department of Environmental Quality has administrative responsibility for NPS pollution, with the Utah Department of Agriculture responsible for day-to-day program management. The Division of Water Quality in the Department of Environmental Quality has prepared an assessment report which describes the nature, extent, and effect of NPS pollution. The Utah Department of Agriculture has prepared a management plan, identifying measures ("best management practices") required and strategies for implementing NPS controls. Congress has asked each state to prepare these two reports. In connection with this responsibility, priorities have been set for NPS control efforts in Utah. As best management systems (BMS) are implemented in the future, and problem areas are controlled, the priority list will be updated and reviewed by the NPS Task Force. Present priorities are based on the following criteria:

1. Designated use of the stream
2. Degree of impairment
3. Population affected
4. Potential for improvement
5. Special considerations (i.e., local support)

Of 21 Utah watersheds prioritized for water quality improvement under this program, three are in the Bear River Basin, and all are in Cache County: Clarkston Creek, Little Bear River, and the Cornish watershed near Clarkston. Water quality problems in each of these areas are described in the following subsection. In each case, animal waste from dairies and feedlots is a problem that is presently impacting water quality. Many other agricultural impacts are apparent, but animal wastes deserve special attention in the Bear River Basin. Table 12-4 shows the relative impact of NPS pollution in the basin and the general sources of pollution.

### 12.4.3 Rich County

Minor water quality impairments in Rich County, include those in cold water fisheries because of temperature, turbidity, and, occassionally, amonia. The impairments result from natural sources, resource extraction, road construction, grazing, and channel modifications. Impacts from total phosphate are also contributed by agricultural activities and from municipal discharge at Evanston. Most contaminated input results from high water during early spring thaw, and from runoff that carries nutrients and sediments into streams from the terrestrial system.

**TABLE 12-4**
**NON-POINT SOURCE POLLUTION IMPACTS**
**BEAR RIVER DRAINAGE[7]**

| Source Category | Major Impact | Moderate to Minor Impact (in stream miles) |
|---|---|---|
| Non-point Sources | | |
| Agriculture | | 310 |
| Resource extraction | | 52 |
| Urban runoff | | 31 |
| Construction | | 22 |
| Hydro/habitat modification | | 11 |
| Land disposal | | 9 |
| Silviculture (forest management) | | 2 |
| Other (natural) | | 629 |

### 12.4.4 Bear Lake

Although the present quality of Bear Lake is very good, the nutrient loading is critical because of the lake's unique chemistry. About 70 percent of the nutrients entering the lake come from the Bear River, which accumulates them from non-point sources upstream. The 30 percent from drainage areas directly tributary to Bear Lake includes wastewater from communities and recreation areas around the lake.

The following statement is from a 1989 Bear Lake water quality summary prepared for the Bear Lake Regional Commission [6].

"Over the last decade, a large amount of water quality data has been collected on Bear Lake. The total inorganic nitrogen data has been consistently around 20-40 ug/l[a] since 1982. Prior to that time, the concentrations were between 40-80 ug/l. Total nitrogen (the sum of all nitrogen components) appears to have a cyclic pattern, reaching highest average concentrations during the wet 1983, 1984 and 1985 time periods.

"Total and ortho-phosphate have both demonstrated an upward trend in concentration. This is especially evident since 1987. Concentrations of total phosphorus regularly exceed 15 ug/l.

"In response to decreased concentrations of nitrogen during 1987-1989 the phytoplankton appear to have decreased. The limnological data indicates that due to high concentrations of ortho-phosphate, nitrogen appears to be limiting the phytoplankton.

"The data for average pH (acidity) levels in the lake over the last decade shows a steady decrease in pH, especially since 1987. This decrease could account for the increased phosphate levels and the concurrent nitrogen limitation. Because the mechanism for pH reduction is unknown, every effort should be made to determine the cause and to adjust management plans accordingly.

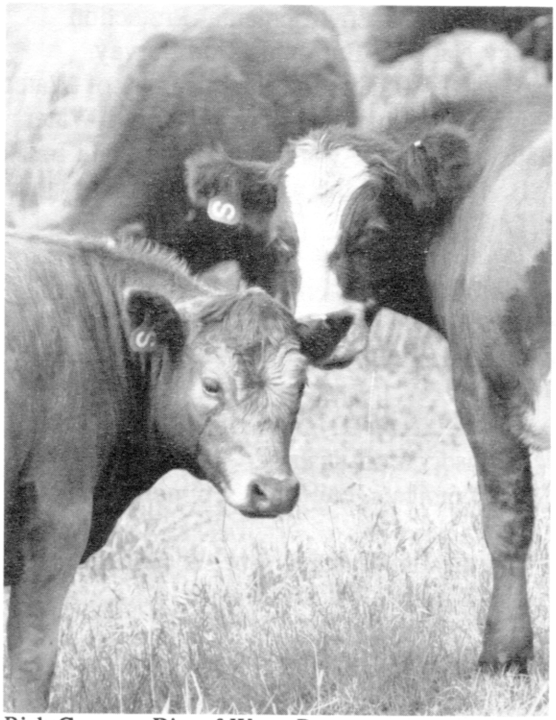
"The production of phytoplankton has decreased during 1987, 1988 and 1989, with no surface concentrations exceeding 1.0 ug/l. This agrees with other data which suggests a decrease in nitrogen and phosphorus loading to Bear Lake during the current dry hydrologic cycle. The decrease in nutrient loading would result in decreased phytoplankton productivity. This level of production is the lowest observed over the last decade."

Although much of Bear Lake's nutrient loading is attributable to inflows from the Bear River, a return to natural conditions (with Bear River bypassing the lake) is not an option. UP&L is obligated by contract and under the Bear River Compact to prudently store spring runoff in Bear Lake and release the stored water during times of downstream irrigation demands. This operation is critical to the economy of the lower basin.

### 12.4.5 Mainstem of Bear River Above Cutler Dam

The Cache Valley segment of Bear River below Oneida Dam contains a substantial level of sediment from unstable stream channels and poor watershed conditions in some areas. Several tributaries, such as Battle Creek and Deep Creek, contribute great quantities of sediment to the Bear River. In addition, irrigation practices have resulted in severe erosion along some bench areas adjacent to the Bear River. Daily streamflow fluctuations from hydropower production at Oneida Dam tend to worsen the streambank instability and sediment problem which already exists. The fine sediment remains in suspension and some passes through Cutler Reservoir to the river below. Much of this sediment has settled out in Cutler Reservoir, as evidenced by its reduced storage capacity.

From the Idaho-Utah state line to Cutler Dam, problems identified are excessive bacteria counts, high ortho-phosphate and nitrate levels, high turbidity, and occasionally high BOD counts. The problems partially originate at cattle confinement and dairy areas from improper manure management practices, and in cropland areas from fertilizer application. Runoff into streams and canals in Cache Valley often carries animal wastes. Some dairy operations, especially those near the communities of Benson and Amalga, have discharged wash water as well as feedlot runoff into the Bear River or into contiguous backwaters and sloughs. Several dairies are located close enough to the river that cattle can walk into the water. In addition, it is suspected that there are some septic tanks presently discharging into the Bear River between Preston and Cutler Reservoir.



Rich County - Div. of Water Resources

Sedimentation and organic enrichment have an impact on the Bear River as described above. However, water quality data do not presently show toxicity problems.

Macroinvertebrate samples support the assumption that heavy metal or pesticide toxicities have not occurred at this location from April 1977 to November 1983. Water quality data did indicate stressful conditions for many species of aquatic organisms, with benthic communities consisting of species considered relatively intolerant to poor water quality but tolerant to sedimentation.

### 12.4.6 Cornish Watershed

The Cornish Watershed contains 37,100 acres, extending 21 miles north to south and six miles east to west. Cornish, Trenton, and Amalga are within the area. This watershed is bounded on the east by the Bear River, on the south by Cutler Reservoir, on the west by the Clarkston Creek Watershed, and on the north by the Utah/Idaho state line. The watershed lies on an east-facing slope with Little Hill and Big Hill on the west. Elevations range from 4,400 feet at Cutler Reservoir to 5,725 feet at the summit of Big Hill. The mean annual precipitation is 17 inches.

Within the watershed, numerous dairy operations inadequately handling livestock waste. Waste management plans and facilities are needed to reduce impacts from this source of pollution.

Most of the 5,000 acres of dry cropland and about 5,000 acres of rangeland within the watershed have highly erodible soils. The extent of erosion and sediment production has not been determined. Crop production on irrigated land in this area is higher than the average for the state. Application of chemical and organic fertilizers is a common practice. Present irrigation and fertilizer management practices and livestock waste management are resulting in an undesirable nutrient yield to the river system.

The adjoining reach of Bear River has been classified for secondary contact recreation, as a warm water fishery, for waterfowl use, and as a supply for agricultural uses. Generally, those parameters which exceed state standards as pollution indicators are total phosphorus and nitrogen. The beneficial use classification for the waters of Cutler Reservoir include: boating and water-skiing, warm water game fish and aquatic life, waterfowl and aquatic life, and agricultural irrigation and stock watering. Total suspended solids and total dissolved solids are excessive in incoming waters. Total phosphorus values exceed the state standards with a mean value of 0.11 mg/l. Cutler Reservoir is nitrogen-limited, and is eutrophic with a mean Trophic State Index of 73.53.

Present data is preliminary and does not quantify or identify specific problem sites. Additional data inventory and analysis work is necessary to allow for effective alternative development and benefit cost analysis. Water quality data specific to this watershed is needed to determine extent of impacts and to determine need for implementation of best management practices.

12.4.7 Clarkston Creek and Newton Reservoir

Water quality problems in Clarkston Creek include high turbidity from soil erosion, high phosphates, and occasional high BOD levels. Newton Reservoir problems have been identified as turbidity, low dissolved oxygen, high nutrients, and excessive algae and macrophyte growth. Newton Reservoir's water quality,[8] at four on-lake sample sites monitored in 1980, was well above the state standard of .025 mg/l for phosphorus as a pollution indicator. Nitrogen was below standards. Phosphorus was the limiting nutrient at all points during both sample dates, except for Clarkston Creek above the reservoir, which was nitrogen limited in August. Bicarbonate readings between 166 and 322 mg/l were indicative of hard water. All water temperatures were within the state standards for warm water fisheries (27°C). Iron concentrations reached as high as 3.88 mg/l. The standard is 1 mg/l. All other trace metals were within bounds. The reservoir stratified acutely with the development of anoxic hypolimnion at close to 10 meters. The waters are within standards for pH.

Following is a summary of biological information including plankton and fisheries gathered for Newton Reservoir during 1980. Fisheries present include yellow perch *(Perca flavescens)*, largemouth bass *(Micropterus salmoides)*, black crappie *(Pomoxis nigromoculatus)*, brown trout *(Salmo trutta)*, bluegill *(Lepomis macrochirus)*, carp *(Cyprinus carpioi)*, and Utah sucker *(Catostomus ardens)*. Phytoplankton present included the toxic pollution algae *Ceratium* and *Aphanizomenon*.

Newton Reservoir was not surveyed during the 1975 Environmental Protection Agency National Eutrophication Survey. Based on 1980 data, the State Bureau of Water Pollution Control (now the Division of Water Quality), using the Carlson Trophic State Index (TSI), determined the reservoir to be eutrophic with a TSI of 67.7.

Current and potential non-point source problems at Newton Reservoir and agencies involved are:

**Agriculture** - North Cache Soil Conservation District
Chemicals, coliform, sediment, organics

**Domestic Sewage** - Local governments
Coliform, BOD, nutrients

**Construction** - Local governments
Sediment, oil, grease, litter, chemicals

**Recreation** - Local governments, state
Litter, sediment, oil, grease

### 12.4.8 Cub River, Logan River, and Blacksmith Fork

Problems in the Cub River are similar to those in the mainstem of the Bear River, including excessive bacteria counts, high ortho-phosphate and nitrate levels, high turbidity, and occasionally high BOD.

The Logan River drainage above the mouth of the canyon has excellent water quality; some problems of high coliform and orthophosphate have been observed on the lower segments of the river. Best management practices to alleviate the water quality problems of the Logan River include management of animal waste, continuation of range management, revegetation of urban land disturbances, protection and enhancement of the riparian corridor from the canyon mouth to Cutler Reservoir, and installation of toilet facilities at Franklin Basin, a recreation area at the headwaters.

High-quality mountain runoff enters the Blacksmith Fork through six main tributaries. With the exception of the lower end, water quality is excellent. Problems in the lower end include bacterial contamination, nutrients, and turbidity. Better management practices for this watershed would pertain to animal-waste handling, range management of the national forest areas, and contour and conservation tillage.

### 12.4.9 Little Bear River Watershed and Hyrum Reservoir

The Little Bear River drainage receives high quality mountain runoff. Two impoundments, Porcupine Reservoir and Hyrum Reservoir, store water for irrigation in southern Cache County and make possible a variety of recreational activities. The major water quality problem of the Little Bear River Watershed is the nutrient loading of Hyrum Reservoir and channel degradation between Porcupine and Cutler reservoirs. Animal waste from dairies and feedlots is a significant contribution of pollution to the Little Bear River. Periodic high concentrations of ortho-phosphate have been observed on the Little Bear River between Avon and Hyrum. Better management practices would include reducing erosion and controlling animal waste runoff. Additional sampling and research are needed to determine exact sources of nutrients before management practices are recommended to control the eutrophic state of Hyrum Reservoir.

The Little Bear River is a major source of sediment, phosphorus, and coliform to Hyrum Reservoir, Cutler Reservoir, and to the Bear River itself. For a selected period, from May 1984 to May 1985, water quality data from the Little Bear River at a point above the confluence with the Logan River was analyzed. Of the 13 samples collected, 11 exceeded the standard for phosphorus, five for nitrogen, six for biological oxygen demand, two for dissolved oxygen, and two for pH.

The Little Bear River system is currently serving as a demonstration area for a river management pilot project. Resources are being focused in this system through the Bear River Resource Conservation and Development (RC&D) Project. The program will determine the feasibility of implementing corrective measures and annual maintenance and preventive programs.

At least five resource problems within the Little Bear River Watershed impact water quality.

The first, and perhaps most obvious, is sediment production from the river channel between Porcupine Reservoir and Cutler Reservoir. The stability of this channel was severely impacted during the 1983 and 1984 flooding events. Still unstable, the channel yields significant amounts of sediment and nutrients to the system. An annual maintenance program is needed to encourage stream channel stability in a cost-effective manner. This program would also encourage and protect other beneficial uses of the stream corridor.

The second problem is inflow from tributary drainages on the lower west side of the watershed. These relatively small areas are dramatically affected by intense summer thunderstorms. During these events, rapid runoff develops inordinately high peak flows, significantly eroding the main and tributary channels. Treatment of these rapid runoff areas would modify the runoff characteristics and reduce sediment/nutrient loading impacts.

A third problem is the excessive amount of nutrient and coliform bacteria entering the system. A major portion of the river's riparian zone, used as pasture, is heavily grazed. Animal waste is a significant problem. Improved grazing and vegetation management, along with improved irrigation management, would reduce water quality impacts from these sources.

The fourth problem is in the upper watershed. Based on a Soil Conservation Service evaluation made in 1987, approximately five percent of the upper watershed (about 8,000 acres) would benefit from improved management, brush control, and some reseeding to reduce sediment yield. A significant amount of phosphorus is being contributed to the system from Davenport Creek and South Fork of Little Bear River. This phosphorus input occurs primarily during spring runoff. Grazing management, riparian zone protection and enhancement, and filter strip establishment would reduce phosphorus inputs.

A fifth problem is the shoreline of Hyrum Reservoir. The western shore of the reservoir is against steep and highly erosive bluffs. Wave action against the toe of the bluffs encourages major sloughing. Armoring the shoreline would protect the bluffs against this wave action.

Sediment and nutrient loading of Hyrum Reservoir is impairing the storage capacity, water quality, fishery, recreation, and aesthetics. An effort has already been initiated to increase the oxygen levels in the reservoir to improve its fishery values. Additional efforts are needed to reduce the remaining impacts.

The river channel between Hyrum Reservoir and Cutler Reservoir meanders through irrigated and naturally wet pastureland. Water quality in this reach is impacted by coliform bacteria, nutrients, and salinity.

### 12.4.10 Main Stem of Bear River Below Cutler Dam, Box Elder Creek, and Malad River

Water quality problems for the segment of the Bear River between Cutler Dam and the Bear River Migratory Bird Refuge are identified as excess levels of phosphates, high turbidity, high concentrations of total and fecal coliform, and occasional high TDS concentrations. Recommended management practices are those related to manure management and soil erosion. The Bear River below the confluence with the Malad River is characterized as moderate to poor in quality and physical habitat. Water temperature, total and fecal coliform, ammonia, boron, alkalinity, nutrients, hardness, TDS, and sulfates were all at, or near, levels considered undesirable. Concentrations of barium were frequently above the 50 mg/l maximum acceptable level for aquatic life, as shown in the Environmental Protection Agency's quality criteria for water, 1986. However, because of naturally high levels of sulfate and carbonate, the barium precipitated out of solution is virtually non-toxic. Low stream flows contributed to the unacceptable water quality and habitat conditions by higher water temperatures and decreasing dilution waters. Banks are stable and covered extensively with riparian vegetation, but plants and animals have few places to thrive because of hard clay bottoms, lack of rapids, high turbidity, total suspended solids, and harsh flow regimes.

The Box Elder Creek drainage includes several tributaries draining the steep slopes of the Wasatch Range from Brigham City to the Weber County line. Mantua Reservoir provides storage of irrigation water, water recreation, and wildlife habitat. One of the major water quality problems in this area is occasional flooding and sedimentation of the Ogden-Brigham Canal, with resultant flooding of orchards and homes. Before management practices are recommended in the Willard-Perry area, a feasibility study is needed to determine methods to reduce flooding. Proposed management practices for Mantua Reservoir include better management of animal waste to reduce nutrient loading.

The lower Malad River is too high in total dissolved solids for agricultural use. The major problems of the river include high TDS and turbidity. The most important source of TDS is Belmont Hot Springs, near Plymouth, Utah, with approximately 8,000 mg/l of TDS. Because mineral springs occur in the streambed, it would be difficult to control sources of these salts. Since the Malad River's salinity problem pervades the entire river, management practices to control salinity are not recommended at this time.

## 12.5 SOLUTIONS OR ACTIONS AVAILABLE

An assessment and planning project is currently underway to better define problem areas, develop solutions, and implement a water quality management framework to protect and enhance the quality of the basin's surface and groundwater resources. Planning and implementation actions are proceeding in some areas of the basin such as the Little Bear River Watershed. In the following sections, some general corrective approaches or actions for each portion of the basin (especially in relation to potential developments) are discussed, starting with the upper basin.

### 12.5.1 Rich County

The Bear River in Rich County is impaired for its current uses as a cold water fishery and for agriculture. River flows are stored during certain periods in Bear Lake. Nutrients and sediment have been identified as the major pollutants in this system. Since nutrients originate with human or animal wastes and from organic matter and sediments, proper pasture and riparian restoration and management would be very beneficial in this system. Beneficial county-wide nutrient control practices include irrigation water management, pasture management, and streambank protection.

### 12.5.2 Bear Lake

The Bear Lake Regional Commission has accepted the responsibility of coordinating all interagency activities for the improvement of Bear Lake. The Bear Lake Preservation Project, sponsored by the commission, is a cooperative effort to maintain the present quality by controlling or reducing the nutrient loading. The commission is attempting to reduce non-point source pollution to the Bear River upstream by encouraging erosion control and better livestock management practices. In the Bear Lake Basin itself, several sewage collection and treatment systems have been completed. One sewage collection system flows north from the state line to treatment lagoons near St. Charles, Idaho. Another flows south and east from the state line to treatment lagoons near Sweetwater Park. A system is needed to collect wastewater from the area around Laketown and the southeastern shore of Bear Lake.[5] In addition, both Sweetwater Park and Rendezvous Beach State Park have separate sewage collection and treatment systems (total containment lagoons).

### 12.5.3 Bear River in Cache Valley

The Utah Department of Agriculture lists the following general practices that would significantly improve water quality. Pollution sources that must be reduced or eliminated are agricultural (natural waste and fertilizer/ pesticide chemicals), septic tanks, and erosional sediment.

County-wide - Animal waste and pasture management in areas where pollutants may enter groundwater.

Newton Reservoir Watershed - Management practices intended to alleviate water quality problems are erosion control on the dry cropland west and north of Clarkston City, mechanical aeration to increase the dissolved oxygen level and fish habitat in Newton Reservoir, and manure management to keep animal wastes out of waterways.

Blacksmith Fork River - Erosion control practices for stream channel protection and for stabilization.

### 12.5.4 Cornish Watershed Area

Excellent opportunities exist to treat agricultural non-point source pollution. Minimum tillage and/or other cultural and management practices can reduce erosion and sediment yield from dry cropland. Brush control and reseeding, along with management practices, can effectively reduce rangeland erosion. Irrigation water management is improving and will continue to do so, but targeted technical and financial assistance would help accelerate this process. The major effort and cost are in the management of livestock waste. Structural practices to handle large volumes of animal waste are expensive, but they can be very effective. Vegetative and management practices can also be effective and, in most cases, can help reduce the cost of animal waste management. Reductions in sediment and nutrient loading of the Bear River would increase fishery values, in the river and in Cutler Reservoir. Reduced sediment and nutrient loading of the reservoir would extend the reservoir life, improve fish and wildlife values, improve recreational values, and reduce health risks to water users.

The existing coordination of public information and education programs by the Extension Service, Utah Association of Conservation Districts, local soil conservation districts, and Utah departments of Agriculture and Environmental Quality has been important in the basin. Continuation of these programs will expand the public's awareness of water quality problems, and may build a stronger desire to participate in improvement activities. With public support and education, significant reductions in animal waste pollution of the Bear River can be achieved. Economic incentives will help even further.

### 12.5.5 Little Bear River

As part of the responsibility to prepare a management plan for controlling NPS pollution, the Utah Department of Agriculture's Environmental Quality Section has identified some best management systems (BMS ) for areas targeted for priority consideration. The Little Bear River is one of these, and the following management and treatment actions were formulated as part of that effort.

To achieve significant protection and enhancement of water quality within the Little Bear River Basin, a sustained, well-managed, watershed maintenance program utilizing the combined capabilities of several organizations and agencies will be required. Through a process of problem identification, effective planning, and efficient practice implementation, existing programs and funds will be focused in a coordinated effort to assist local land owners and local organizations implement needed treatment measures.

Water quality improvement and protection and land enhancement in the Little Bear River system can be achieved by implementing a multi-faceted watershed management program. The Little Bear River Watershed has been approved as a "hydrologic unit area" by the SCS. A steering committee has been organized under the direction of the Blacksmith Fork Soil Conservation District to provide leadership and direction for project planning and implementation. A technical advisory committee was also organized to research all possible data, assemble, organize, and assist in plan development.

Financial support is being provided by local government entities, private sources, and existing state and federal programs. Other support is provided in the form of in-kind services and/or materials. Local, private, and county support is provided primarily as in-kind services such as labor, equipment, and/or materials.

Based on a watershed evaluation made by the Soil Conservation Service, about 8,000 acres of rangeland (five to six percent of the total rangeland) are eroding excessively and yielding large amounts of sediment to the river system. These areas have been identified and will be treated, utilizing existing state and federal assistance programs in support of local land owner initiatives. Improving rangeland management, along with some brush management, reseeding, fencing, and livestock water development, will effectively reduce sediment impacts on water quality. Treatment will consist of a combination of best management practices which are expected to reduce erosion, but also benefit wildlife and forage production needs, archaeological and historical values, and aesthetics.

At an estimated average cost of $30 per acre, the total treatment cost for the 8,000 acres of critical rangeland is expected to be approximately $240,000. Existing and special Agricultural Stabilization and Conservation Service (ASCS) cost-share program funds, Agricultural Resources Development Loan program funds, hydrologic unit area funds, EPA 319 funds, and other water quality program funds will be targeted to this effort.

The South Fork of the Little Bear River, Davenport Creek, Spring Creek, and the lower Little Bear River are also impacted by nutrient loading. In addition, the lower Little Bear River receives an excessive amount of coliform bacteria. Sediment loading also occurs from overland flow erosion. Enhancement of the riparian zone and animal waste management would effectively reduce the nutrient impacts. Establishment of riparian vegetative filter strips would catch and utilize sediment and nutrients resulting from overland flow. Pasture management, irrigation water management, fencing, and filterstrip improvement would effectively reduce nutrient impacts on the Little Bear River system. Streambank protection, flood protection, and improved fishery values are additional benefits from these activities.

## 12.6 RECOMMENDATIONS

These recommendations relate to the preparation of a water quality management plan for the Bear River Basin, and the planning and implementation of a non-point source water quality project on the Little Bear River.

### 12.6.1 Water Quality Management Plan

The Utah Division of Water Quality should prepare a Water Quality Management Plan for the Bear River Basin. Currently, water quality assessments and management strategies are being prepared by the Division of Water Resources in cooperation with the Department of Environmental Quality. This effort will provide a framework for continuing the effort to formulate a water quality management plan. This plan will assure protection of water quality to support designated beneficial uses.

### 12.6.2 Little Bear River Non-point Source (NPS) Water Quality Project

The Soil Conservation Service, the Utah Department of Agriculture, the Division of Water Quality, and other appropriate agencies should accelerate preparation and implementation of a Water Quality Management Plan for controlling NPS pollution for the Little Bear River watershed.

## 12. REFERENCES

In addition to references listed below, Section 12 of the Utah State Water Plan, January 1990, discusses water quality activities in the state and five water pollution control issues.


1. "Wasatch Front Total Water Management Study - Bear River Basin", U.S. Bureau of Reclamation and Utah Division of Water Resources, Preliminary Field Draft, August 1987.

2. "Water Quality management Studies for Water Resources in the Bear River Basin," Utah Water Research Laboratory (for Utah Division of Water Resources), January 1986.

3. "Reconnaissance Report, Bear River Basin Investigation, Idaho-Utah-Wyoming," Corps of Engineers, Draft Stage, February 1989.

4. "Wastewater Disposal Regulations Part II Standards of Quality for Waters of the State," Utah Department of Health, Revised by Action of Utah Water Pollution Control Committee April 21, 1988.

5. Telephone interview with Craig Thomas, Bear Lake Regional Commission, on March 13, 1990.

6. "Bear Lake 1989 Water Quality Summary," Ecosystems Research Institute, for Bear Lake Regional Commission. March 1990.

7. "State of Utah 305(b) Biennial Water Quality Report," Roy D. Gunnell, Utah Department of Health, October 1988.

8. "State of Utah Clean Lake Inventory and Classification," Utah Department of Health, April 1982.

9. "Bear River Basin Water Quality," Utah Department of Health, September 1989.

10. "Bear River Water Quality: Bioavailable Phosphorus Measurement, Sources, and Control," Utah Water Research Lab, December 1989.